CLAIMS

What is claimed is:

1. A catalyst for use in oxidation or reduction reactions, the catalyst comprising platinum, indium, and at least one of tungsten, iron, and manganese.

2. The catalyst of claim 1 consisting essentially of platinum, indium, and at least one of tungsten, iron, and manganese.

3. The catalyst of claim 1 wherein the catalyst is an alloy comprising platinum, indium, and at least one of tungsten, iron, and manganese.

4. The catalyst of claim 1 wherein platinum is at a concentration that is between about 5 and about 65 atomic percent.

5. The catalyst of claim 1 wherein indium is at a concentration that is between about 5 and about 80 atomic percent.

6. The catalyst of claim 1 wherein indium is at a concentration that is between about 5 and about 50 atomic percent.

7. The catalyst of claim 1 wherein tungsten, iron, manganese, or a combination thereof is at a concentration that is between about 10 and about 85 atomic percent.

8. The catalyst of claim 1 wherein platinum is at a concentration that is between about 5 and about 60 atomic percent, indium is at a concentration that is between about 5 and about 50 atomic percent, and tungsten, iron, manganese, or a combination thereof is at a concentration that is between about 10 and about 85 atomic percent.

9. The catalyst of claim 1 wherein platinum is at a concentration that is between about 10 and about 50 atomic percent, indium is at a concentration that is between about 10 and about 40 atomic percent, and tungsten, iron, manganese, or

a combination thereof is at a concentration that is between about 20 and about 70 atomic percent.

10. The catalyst of claim 1 wherein platinum is at a concentration that is between about 10 and about 30 atomic percent, indium is at a concentration that is between about 5 and about 30 atomic percent, and tungsten is at a concentration that is between about 40 and about 80 atomic percent.

11. The catalyst of claim 1 wherein platinum is at a concentration that is between about 50 and about 60 atomic percent, indium is at a concentration that is between about 20 and about 30 atomic percent, and tungsten is at a concentration that is between about 15 and about 25 atomic percent.

12. The catalyst of claim 1 wherein platinum is at a concentration that is between about 25 and about 65 atomic percent, indium is at a concentration that is between about 5 and about 50 atomic percent, and iron is at a concentration that is between about 10 and about 60 atomic percent.

13. The catalyst of claim 1 wherein platinum is at a concentration that is between about 30 and about 50 atomic percent, indium is at a concentration that is between about 15 and about 45 atomic percent, and iron is at a concentration that is between about 15 and about 50 atomic percent.

14. The catalyst of claim 1 wherein platinum is at a concentration that is between about 45 and about 55 atomic percent, indium is at a concentration that is between about 20 and about 30 atomic percent, and iron is at a concentration that is between about 20 and about 30 atomic percent.

15. The catalyst of claim 1 wherein platinum is at a concentration that is between about 10 and about 50 atomic percent, indium is at a concentration that is between about 5 and about 30 atomic percent, iron is at a concentration that is between about 15 and about 80 atomic percent, and manganese is at a concentration that is between about 1 and about 15 atomic percent.

16. The catalyst of claim 1 wherein platinum is at a concentration that is between about 30 and about 45 atomic percent, indium is at a concentration that is between about 15 and about 30 atomic percent, iron is at a concentration that is between about 20 and about 45 atomic percent, and manganese is at a concentration that is between about 3 and about 12 atomic percent.

17. The catalyst of claim 1 wherein platinum is at a concentration that is between about 10 and about 50 atomic percent, indium is at a concentration that is between about 10 and about 80 atomic percent, and manganese is at a concentration that is no more than about 60 atomic percent.

18. The catalyst of claim 1 wherein platinum is at a concentration that is between about 20 and about 40 atomic percent, indium is at a concentration that is between about 40 and about 70 atomic percent, and manganese is at a concentration that is between about 5 and about 40 atomic percent.

19. The catalyst of claim 1 wherein platinum is at a concentration that is between about 25 and about 35 atomic percent, indium is at a concentration that is between about 50 and about 70 atomic percent, and manganese is at a concentration that is between about 10 and about 30 atomic percent.

20. The catalyst of claim 1 wherein platinum is at a concentration that is between about 25 and about 65 atomic percent, indium is at a concentration that is no more than about 55 atomic percent, tungsten is at a concentration that is no more than about 40 atomic percent, and manganese is at a concentration that is no more than about 40 atomic percent.

21. The catalyst of claim 1 wherein platinum is at a concentration that is between about 35 and about 55 atomic percent, indium is at a concentration that is between about 10 and about 40 atomic percent, tungsten is at a concentration that is between about 10 and about 30 atomic percent, and manganese is at a concentration that is between about 10 and about 30 atomic percent.

22. A supported electrocatalyst powder for use in electrochemical reactor devices, the supported electrocatalyst powder comprising a catalyst that comprises platinum, indium, and at least one of tungsten, iron, and manganese, and electrically conductive support particles upon which the catalyst is dispersed.

23. A fuel cell electrode, the fuel cell electrode comprising electrocatalyst particles and an electrode substrate upon which the electrocatalyst particles are deposited, the electrocatalyst particles comprising a catalyst that comprises platinum, indium, and at least one of tungsten, iron, and manganese.

24. The fuel cell electrode of claim 23 wherein the electrocatalyst particles comprise electrically conductive support particles upon which the catalyst is dispersed.

25. A fuel cell comprising an anode, a cathode, a proton exchange membrane between the anode and the cathode, and a catalyst that comprises platinum, indium, and at least one of tungsten, iron, and manganese for the catalytic oxidation of a hydrogen-containing fuel or the catalytic reduction of oxygen.

26. A method for the electrochemical conversion of a hydrogen-containing fuel and oxygen to reaction products and electricity in a fuel cell comprising an anode, a cathode, a proton exchange membrane therebetween, a catalyst that comprises platinum, indium, and at least one of tungsten, iron, and manganese, and an electrically conductive external circuit connecting the anode and cathode, the method comprising contacting the hydrogen-containing fuel or the oxygen and the catalyst to catalytically oxidize the hydrogen-containing fuel or catalytically reduce the oxygen.

27. The method of claim 26 wherein the hydrogen-containing fuel consists essentially of hydrogen.

28. The method of claim 26 wherein the hydrogen-containing fuel is a hydrocarbon-based fuel selected from the group consisting of saturated hydrocarbons, garbage off-gas, oxygenated hydrocarbons, fossil fuels, and mixtures thereof.

29. The method of claim 26 wherein the hydrogen-containing fuel is methanol.

30. An unsupported catalyst layer on a surface of an electrolyte membrane or an electrode, said unsupported catalyst layer comprising platinum, indium, and at least one of tungsten, iron, and manganese.